

WHAT IS CLAIMED IS:

1. A method for estimating the error statistic for retrieved temperature and emissivity of a surface material, comprising:

- 5 determining the second order analytical error propagation for surface temperature and emissivity of a surface material;
- retrieving surface temperature and emissivity from a sufficiently large ensemble of radiance spectra by Monte Carlo simulation; and
- 10 determining the error in retrieved surface temperature and emissivity arising from random instrument noise from analytical error propagation and/or Monte Carlo simulation.

2. The method for estimating the error statistic as in Claim 1, wherein determining the second order analytical error propagation comprises determining the covariance and bias surface temperature and emissivity errors retrieved utilizing an
- 15 ISSTES algorithm.

3. The method for estimating the error statistic as in Claim 1, wherein retrieving surface temperature and emissivity by Monte Carlo simulation comprises
- 20 generating an unbiased ensemble of measurement errors for the covariance of the measured variables.

4. The method for estimating the error statistic as in Claim 3, wherein retrieving surface temperature by Monte Carlo simulation comprises adding errors to
- 25 produce an ensemble simulating the results of making the same measurement many times.

5. The method for estimating the error statistic as in Claim 4, wherein retrieving surface temperature by Monte Carlo simulation further comprises
- 30 evaluating an ensemble of measurement utilizing the function $F(X)$ to generate an ensemble of dependent variables.

8. The method for estimating the error statistic as in Claim 1, wherein determining the second-order analytical error propagation comprises translating a radiance error of a surface material into a diagonal covariance matrix.